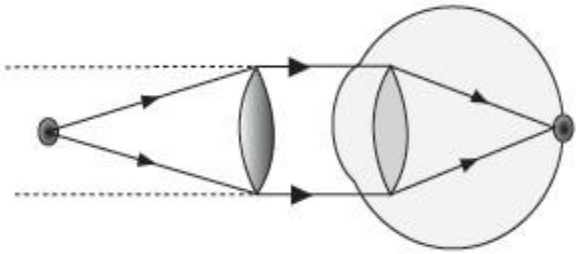
S4 PHYSICS MARKING GUIDE

1) (a) diminished **1mark**
(b) equal **1mark**
(c) magnified **1mark**
(d) Without deviation **(1mark)** undeflected, undeviated
(e) Dispersion (**1mark)** or refraction towards the base of prism

2) a) **Long-sightedness (hypermetropia) (2 marks)**
b) This defect can be corrected by wearing a convex lens spectacle. The rays of light from a near object are converged so that the rays appear to come from a point far, and so are focused by the eye. **(3 marks)**



Rays from a near object O appear to come from a distant object.

3)

The object distance u = + 20cm
Focal length, f = + 15cm
Using $\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$

$\frac{1}{15}=\frac{1}{20}+\frac{1}{v}$ **(1mark)**

$v=60cm$ **(1.5marks)**

The position of image is $60cm$
Magnification

$M=\frac{v}{u}=\frac{60}{20}=3$ **(1.5marks)**

Therefore the image is real, inverted and three times taller than the object. **(2 marks)**

4)

a) Normal adjustment of an astronomical telescope is a condition for which produces a final image which is at infinity.
At this condition the eye is relaxed. **(2 marks)**

b)Let f_o and f_e be the focal lengths of the objective and eyepiece respectively

i)magnification $M = \frac{f_o}{f_e} = \frac{120}{5} = 24$ **(3 marks)**

ii) $separation = f_o + f_e = 120 + 24 = 124\,cm$ **(3 marks)**

5)

$\sum \vec{F}_y = 0$, $X + Y - 3 = 0$ **(0.5mark)**

Or $X + Y = 3$ (1)

$\sum \vec{\tau}_{ext} = 0$ (about the fixed point)

Taking the fixed point A

$X(AB) - 3(AG) + Y(AB) = 0$ **(0.5mark)**

$0 - 3(0.4) + Y(0.6) = 0$ (2)

$Y(0.6) = 3(0.4)$ $Y = 2N$ **(1mark)**

Eq (1) becomes $X + 2 = 3$ **(1mrk)**

Where $X = 1N$ **(1 mark)**

6) A)

Physical quantity	meaning
A.	6 **(1 mark)**
B.	5 **(1 mark)**
C.	4 **(1 mark)**
D.	2 **(1 mark)**
E.	7 **(1 mark)**
F.	1 **(1 mark)**
G.	3 **(1 mark)**

b) in a system of interacting or colliding bodies a total linear momentum remains constant or is conserved provided non external force acting on the bodies/system of bodies**.** **(2 marks)**

7)

a Momentum and kinetic energy **(2 marks)**

b)

$$\text{Momentum} = 0.014 \times 640 = 8.96$$
$$\approx 9.0\,\text{kg m s}^{-1}$$ **(3marks)**

8)

a) Length of the conductor **(1mark)**

Nature of the conductor **(1mark)** and

Cross sectional area of the conductor

9)

a)Fossil fuelis non-renewable energy source that began to form millions of years ago from the remains of once living plants and animals.
Renewable energy source can berecycled or replaced at a rate faster than they areconsumed.**(2marks)**
b) Nuclear energy**(1mark)**
c)Solar energy, wind energy, hydroelectric energy, (any one example)**(1mark)**
d)Petroleum, coal and natural gas.(any one example)**(1mark)**

10) The world needs to changefrom this current dependence on the use of non renewable energy resources. The use of oil and coal must be replaced with all kinds of alternative energy sources. One part of thesolution is using biodiesel or bio-fuel made of waste from croplands. **(3marks)**

11) Degradation of energy is explained as the situation where the transformation of energy into any form results in its less availability to do the said work, hence it is a gradual decrease of useful energy. **(2marks)**
Example :
A large part of electrical energy is wasted in the form of heat energy when electrical appliances are run electricity **(1mark)**
A large part of heat energy from the fuel is given out when foot is cooked over fire .The liberated energy is of no use, instead cause pollution.

12) a)

$$\textit{Wasted energy} = 2000 \text{ joules} - 600 \text{ joules} = 1400 \text{ joules}$$ **(2marks)**

b)

$$\text{Efficiency } E = \frac{\textit{Useful energy}}{\textit{In put energy}} = \frac{600}{2000} = 30\%$$ **(2marks)**

13) In a hydropower plant, water is usually reserved in constructions like a dam and it has potential energy **(1mark).** This is converted into kinetic energy **(1mark)** and the turbine of the hydropower plant converts the kinetic energy of falling water into mechanical energy **(1mark)** because water hits its blades and causing it to spin, then the generator converts the mechanical energy from the turbine into electrical energy **(2marks)**

14) E. The car's acceleration is directed toward the center **(2marks)**

15) **a)** Projectile motion is the motion of an object thrown or projected into the air, subjected to only the acceleration of gravity. **(2marks)**

b) real life examples of projectile motion

-A soccer ball kicking, a golf ball playing, a basketball thrown into basket, firing a bullet from gun, launching a rocket…..**(2marks)**

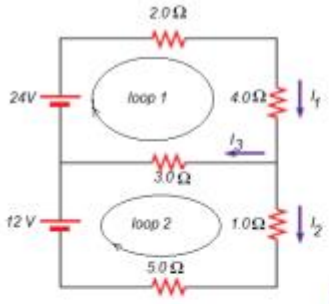
16)

.(a)Kirchhoff's rules state that:

*1. The sum of the currents entering any junction must equal the sum of the currents leaving that junction. (This rule is often referred to as the junctionrule.)***(1mark)**

*2. The sum of the potential differences across all the elements around any closed circuit loop must be zero. (This rule is usually called the loop rule.)***(1mark)**

b)



(2marks)

Current rule

$I_1 = I_2 + I_3$ (1)**(1mark)**

From the loop 1

$24 - 2I_1 - 4I_1 - 3I_3 = 0$

$6I_1 + 3I_3 = 24$ (2)**(1mark)**

From the loop 2

$12 + 3I_3 - I_2 - 5I_2 = 0$

$3I_3 - 6I_2 = -12$ (3)**(1mark)**

Solving Eq. (1), (2) and (3) simultaneously we get

$I_1 = 3.5A$, **(1mark)**

$I_2 = 2.5A$ **(1mark)**and

$I_3 = 1A$ **(1mark)**

17) Energy generation and treatment (degradation) are associated to negative and harmful environmental effects such as:
- Deformation
-Deforestation
- Soil and land degradation,
- Water pollution,
- Air pollution,
- Global warming,
- Ozone layer depletion.
-Climate change
-Thermal pollution
-Solid waste disposal

NOTICE: Any four points **(4 marks)** with short explanation (**4 marks)** **(1 mark)** for introduction and**(1 mark)**conclusion

Example

Energy and environmental problems are closely related, since it is nearly impossible to produce, transport, or consume energy without significant environmental impact. The environmental problems directly related to energy production and consumption.

The emission of air pollutants from fossil fuel combustion is the major cause of urban air pollution.

Burning fossil fuels is also the main contributor to the emission of greenhouse gases.

Diverse water pollution problems are associated with energy usage. One problem is oil spills. In all petroleum-handling operations, there is a finite probability of spilling oil either on the earth or in a body of water.

Coal mining can also pollute water. Changes in groundwater flow produced

by mining operations often bring otherwise unpolluted waters into contact
with certain mineral materials which are leached from the soil and produce
an acid mine drainage

Solid waste is also a by-product of some forms of energy usage. Coal mining
requires the removal of large quantities of earth as well as coal.

Agricultural crops such as oil palm, sugar cane, maize, rapeseed, soybeans
and wheat, are being used to produce liquid biofuels, mainly to power vehicles. But the increased use of agricultural lands for growing energy crops may compete with food production, causing increased food prices and deforestation

18) Given that projection angle is $\theta=30^0$

Initial velocity, u=25m/s

a) Horizontal component:

$ux = u\cos\theta = 25\cos30^0 = 21.65m/s$ **(1mark)**

vertical component:

$uy = u\sin\theta = 25\sin30^0 = 12.5$m/s **(1mark)**

b) The maximum height attained.

$H = u^2\sin^2\theta / 2g = (25)2\sin^2 30^0\ 2x10 = 7.81$m **(2marks)**

c) The time of flight $T = 2u\sin\theta\ /g$

$= 2x25\sin300\ 10 = 2.5$ **(2marks)**

d) The time to reach maximum height,

$T = 0.5x2.5 = 1.25s$ **(2marks)**

f) Horizontal range R: $R = u^2\sin2\theta / g$

$=(25)2\sin2(300)\ 10 = 54.13m$ (**2marks)**

19) a) The refracting telescope uses a combination of lenses to form an image **(1mark)** while the reflecting telescope uses one concave mirror called objective and eyepiece is a convex lens. **(1mark)**

b) Differences between microscopes and telescope are the following: **3marks)**

Microscopes	Telescopes
Used to magnify small objects	To magnify large objects
Placed close to the small object	Situated far away from objects

Small	Large
Small aperture	Large aperture
Often use artificial light	Use natural light
Objective lens has small focal length	Objective has short focal length
In normal adjustment, final image is formed at near point	Final image is formed at infinity
They are made by lenses	Some of them use mirror or prism
Etc.	

c) The linear magnification= $\frac{f_o}{f_e} = 30$ **(1 mark)**

and

$f_o + f_e = 124$ **(1 mark)**

So, $30f_e + f_e = 124$ **(1 mark)**

$31f_e = 124$ and $f_e = 4cm$

The focal length of eyepiece $(f_e) = 4cm$ **(1 mark)**

The focal length of objective $f_o = 4cm \times 30 = 120cm$ **(1 mark)**

20) a) (i)-Stable equilibrium **(1mark)**

-Unstable equilibrium **(1mark)**

-Neutral equilibrium **(1mark)**

ii)

- Net force is equal to zero **(1mark)** or Algebraic sum of x and y components of the external forces applied to the object must be equal to 0 respectively.
- Net torque is equal to zero **(1mark)** .The algebraic sum of the clockwise torques is equal to the algebraic sum of the counterclockwise torques.

b) The free-body diagram showing all the external forces acting on the ladder is illustrated in Figure b. below.

The reaction force **R** exerted by the ground on the ladder is the vector sum of a normal force n and the force of static friction **fs** . The reaction force **P** exerted by the wall on the ladder is horizontal because the wall is frictionless. Notice how we have included only forces that act on the ladder.

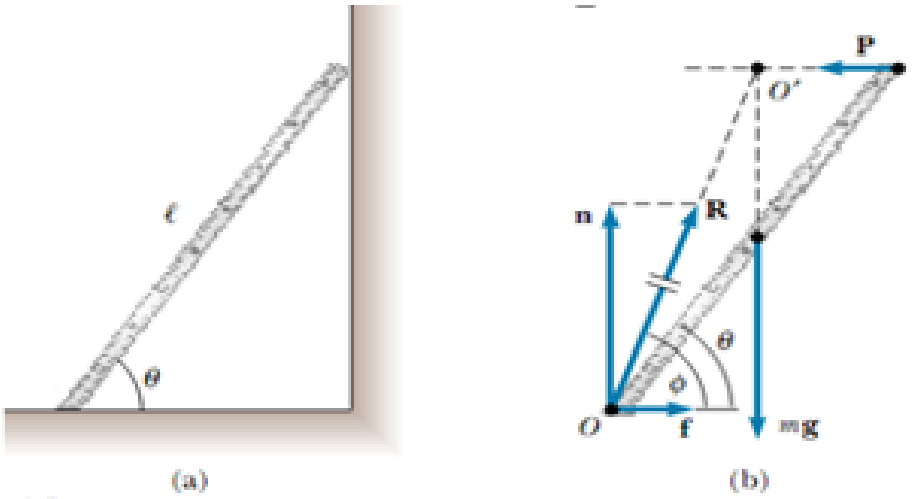


Figure (a) A uniform ladder at rest, leaning against a smooth wall. The ground is rough. (b) The free-body diagram for ladder. Note that the forces R, mg, and P pass through a common point O'

For example, the forces exerted by the ladder on the ground and on the wall are not part of the problem and thus do not appear in the free-body diagram. Applying the first condition for equilibrium to the ladder, we have

$$\sum F_x = f - P = 0$$
$$\sum F_y = n - mg = 0$$

$$fs,max = \mu_s n = 0.40(50\,N) = 20\,N$$ (Recall that $fs = \mu_s n$) **(1mark)**

To find Θ_{min}, we must use the second condition for equilibrium. When we take **the torques (** $\sum \tau = 0$) about an axis through the origin **O** at the bottom of the ladder, we have

$$\sum \tau_0 = Pl\sin\theta - mg\frac{l}{2}\cos\theta = 0$$; **(2marks)**

Because **P =20 N** when the ladder is about to slip, and because **mg= 50 N**, this expression gives

$$\tan\theta_{min} = \frac{mg}{2P} = \frac{50n}{40N} = 1.25 \Rightarrow \theta_{min} = 51^0$$
$$\Rightarrow \theta_{min} = 51^0$$ **(2marks)**